TS Disk Ref

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Hobby Project.

Welcome aboard! This is the first issue of an occasional newsletter intendended to support the several disk systems of the Sinclair community. Since the writer uses the Larken LDOS TS1000 system, most of the examples of specific cases will concern that system but general coverage of the principles of disk use common to most systems will make this newsletter of broader interest. Some attempt at covering news and supplier information will be attempted as well by surveying the user group newsletters and tapping into the rumour mill that we all know and love.

This first issue contains an article on handling diskettes for the beginner mainly but the seasoned user may find a few tidbits previously not encountered and of a technical origin too. An article on disk drive operating system concepts and history follows. A semi-technical article on the principles of magnetic disk recording explains the basic factors that affect the smooth operation of recording and interfere with it when things go wrong.

It is hoped that this newsletter will come out in alternation with the regular TS Bulletin and represents a change with the times as Sinclair use is becoming more sophisticated as more users move up to disk systems.

News, Supplier Addresses and Info From The Rumour Mill

- Will diskette prices skyrocket? Rumours are circulating that the U.S. government is accusing oriental and Japanese specifically diskette makers of unfair competition. Remember what happened to prices when they did this for memory chips?
- LDOS Larken Systems for the TS1000 - still available??? — Larken Electronics has sent its stock to Jim Horne, #3, 3050 Kingsway, Vancouver, B.C., Canada V5R 5J7.
- Rumours of price increases on the British, Miracle Systems disk systems for the QL have been circulating in the user groups. The Trump and Ace boards are very popular and now that MS DOS and CP/M emulators are available for the QL, disk system sales should rise even further. Emulators are being sold by Sharps, RMG.
- Work on an unofficial technical manual for the Larken TS1000 LDOS disk system is continuing with release anticipated for the fall. It is anticipated as well that the final version should run to over 80 pages. Early drafts have been sent to the Toronto User Group for criticism and review. Some of the material for this newsletter has been drawn from its pages if you are interested in what it will be like.
- A hard disk controller is said to be available now from Britain for the QL, £185.

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------Sent free, gratis and for nothing to certain Sinclair user groups.------

General Information for the Beginner

Diskettes - Special Precautions

There are a number of things that one should bear in mind in using the magnetic diskettes (5¼ inch double-sided double-density) that the system uses. As with cassette tapes you don't want to get finger prints or oil on the recording surface which is the brown area showing through the holes in the cardboard jacket (which should NEVER be taken off the diskette). Also dust or even cigarette smoke's microscopic particles and any hard surface (including a note shoved into the jacket with the diskette) should not come in contact with the diskette.

Never place the diskette near a magnet such as your television's speaker or on top of your cassette recorder (where the speaker magnet is). Similarly diskettes and the drive should be kept a minimum distance away from a switching power supply such as the one that is often sold with the system.

Never leave the diskette anywhere it might get hot (in a car in the summer, on a radiator or heating vent, on top of the t.v. or monitor). Also keep any toy or other kind of magnet or magnetic labels far away from where you use your diskettes. The rumour from Toronto that the magnets in subways damage them if you take them on one with you and sit near a motor has been denied by officials.Spilling any food or drink on them is also trouble. If you must write on a diskette label once it is stuck to the diskette, use only a soft, felt tip pen. Paper clips, staples, clamps, folding or creasing also are likely to ruin a diskette. When mailing, use cardboard on both sides.

Why are we worried about damaging a diskette which may only cost 50¢? The answer is that the program on it may have taken days to write and debug and may be lost forever. Which leads us to another thing, always back up your work several times. With the Larken disk drive this only takes a matter of a minute or two, most of which is time spent in handling the diskettes. If you save an updated program under the same label, the old version is lost.

Proper dust proof diskette boxes for storing diskettes cost only $5-10 and are a good investment. Some even have locks to keep out the prying, inquisitive hands of little ones (who might like to play'flying saucer' etc.)!

Formatting a diskette is what you must do before it can be used and since formatting writes zeros into the storage area for files and programs on the diskette, formatting a used diskette will ruin any data on it. Because the whole storage area of the diskette must be written on, formatting takes the longest time of any disk activity. So a blank diskette right from the box or one used on another make of computer for a while will not work on your disk drive system until it has been formatted in your system.

How much will a diskette hold? That depends on the disk system. The Larken LDOS system diskettes hold about 156K per double sided 5¼ in. diskette. That is about the capacity of most first generation disk drives including the Commodore 64 and IBM (PC DOS version 1), although IBM and many others soon moved to the 300-400K capacity range on the 5¼ diskette. There are too other factors in the amount that a diskette will hold. Typically the Sinclair's systems when they first came out were offered in both double and single-sided flavours and of course the single-sided versions held half as much data. The other factor is that a system will use disk space only in units of a fairly large order. If a roughly 2K track is the smallest unit, then 79-100 byte programs (8K or so) will fill the whole disk (although in the case of the LDOS system it will not allow as many as 79 separate files per disk). However the amount of data a disk will hold under the best conditions depends on how it is formatted and LDOS system format routines (if single-sided, 79 K) will produce disks that will hold only that much, and IBM computers can have their 5¼ diskettes formatted to 320K, 360K or 400K and then save the corresponding amount of data (altho the latter requires a system file too on the system disk to use the 400K format. The important thing to remember is that you create beaucoup trouble for yourself if you don't watch when a diskette is getting nearly full.and try and save one big file too many on it then.

TS Disk Ref Vol. I No. 1

Disk Drive Systems From The Software View

What is a disk drive operating system? What for that matter is an operating system? From the view of the history of computers, the early ones had to be started and stopped for every job. The programmer reset the program counter to zero, started up the computer from the last job which ended perhaps with a machine language HALT command, and would watch a bank of pilot lights to see what parts of the memory were active to try to guess what was going on. It soon became obvious that time was being wasted in the operator's slowness in pressing these sequences of buttons on computers that were perhaps already running 24 hours a day to avoid wasting the time of a possibly $1 million machine. The solution used was to program a smaller computer to do the equivalent of pressing the buttons of the larger one to start and stop and go through a line-up of jobs, running one after the other as quickly as possible. Then, messages were sent to the computer room personnel to put the computer cards for this or that job in the hopper, to place this or that tape on drive #1 or #3 and so on. It later occurred to computer makers that rather than having two computers, the main computer could run a program in its memory that the manufacturer would supply and that would do everything that the second 'operator' computer had done in the two-computer arrangement. This program, the most famous of the pioneers being the DOS of the IBM 360, was called the operating system. The manufacturer would supply it with the sale of the computer.

This program would have a series of commands that would make some sense to the user, just like the statements of a programming language like BASIC make some sense to the programmer (like PRINT, which is also an English word), but be translatable into computer actionable form, machine language, by the computer program itself. A computer like the Timex-Sinclair runs backwards compared to the early big computers. Instead of having an operating system that would run compilers and compiled programs, (or in say the IBM PC microcomputer, interpreters like GW BASIC), it has a BASIC interpreter, including a program editor and the BASIC commands. These latter run and act within a program or outside a program as immediate commands, one at a time. Some like RUN and NEW double as OSCL commands.* They are called by a monitor, a loop program, that goes from looking for input in the keyboard, to looking for output from BASIC commands, to writing the contents of the display file (where the output from the BASIC programs usually goes) on the television screen output, and back to the BASIC instruction within a program (or outside, in the case of immediate/ command mode). This main loop is in the ZX-81/TS1000 called a monitor. (In computers that have a small monitor loop and a lot of device drivers to do the separate tasks, like input and output, this smaller loop is called a kernal).

Some computers like the Commodore 64 have built-in BASIC/operating system commands to handle disk drive operations like disk save, load and pulling a directory of contents of the diskette. The TS2068 set aside some commands to do this in case a disk drive was later added by the manufacturer but it has no machine language program in the computer's ROM to actually run a disk drive (start and stop the motors, input and output through ports for data etc.). The TS1000/ZX-81 didn't even have these command codes in its Sinclair code.

So how do we get the extra commands and their machine language decoding and disk drive handling routines in a TS1000/ZX-81? Well, how would we get the commands of another programming language like FORTH or Pascal into the computer instead of only running the commands available in the built-in BASIC? We write a machine language program to convert the instructions of say Pascal into machine language instructions. That is what the programmer did in writing the compiler or interpreter for FORTH, Pascal etc. A disk operating system is similar to that. A series of machine language routines that will input from the keyboard commands like SAVE or FORMAT and interpret them to see what is wanted done to be done and call appropriate machine language subroutines and algorithms to do them. Algorithms like that to determine how long the program to be saved on disk is, and to save it on disk, making entries on a block map to show which blocks and tracks on the disk are used to save which parts of which program given the user's label in the diskette's directory are included in the disk operating system.

The ZX-81/TS1000 Larken system chose to put this machine language program, the LDOS disk operating system in a special 2K ROM on the disk interface board. It is called by a PRINT USR command followed by the address of the start of that ROM (14336). A machine language operating system loaded into normal 16K RAM could also be written by a third party software developer and used instead.

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*OSCL=Operating System Command Language =BATCH FILE Lang.(MS DOS),=JCL (IBM 360)

Magnetic Recording - Disk And Cassette Media

Some of the earliest commercial magnetic recording was done in Germany and England at the time of the Second World War using simply an iron wire that was wound on spools in the wire recorder. The idea of using a coating of iron oxide on a paper or now a plastic tape originated in Germany alone. The original medium of plastic tape was cellulose acetate although the strength of Mylar (a polyester plastic) soon had it replacing the cheaper acetate tapes. The magnetic coating most widely used is iron III oxide (ferric oxide) altho other medias and mixtures have been experimented with recently. Chromium oxide and metal rather than oxide of a metal particles have also been used in commercially sold cassette tapes.

The property of the magnetic coating that is utilized is its ability to take and keep a small magnetic field (creation of a small magnet) on its surface. The ability to retain this magnetization over time after it has been done by saving a program to disk or tape is its magnetic retentivity. This can be seen in its properties as plotted in the standard B-H hysteresis curve found in electronic textbooks, sometimes referred to as the hysteresis loop. This loop shows a lagging in magnetization and demagnetization, the more acute the lag, the squarer the loop, so that square loop hysteresis is a good characteristic for a magnetic medium such as the oxide coating to have.*

The little induced permanent magnets formed on the magnetic coating of the disk or tape can be oriented accross, in line with or into the depth of the magnetic medium in relation to the direction of movement of the disk or tape. These are called transverse, longitudinal and vertical recording and they all have been tried at one time or other in the computer game although the standard settled on and probably the simplest to do, has been longitudinal (magnets running N-S in the direction of recording or rewind).

The size of the little magnets on the tape or disk obviously limits the density of the recording possible (bit rate per inch of tape for example). These little magnets or areas of magnetism are limited by the particle size and uniformity of the magnetic coating, much like the size of the grain limits sharpness in photo film. A great deal of the expertise in making good disks and tapes is related to the expertise in working with fine coatings and making them uniform and it is not surprising that with the Kodak or Fuji photo company's expertise in making coatings uniform with film that they have moved into the magnetic media field too as a related technology. Imperfections in the size or thickness of coating limit not only the effective baud rate/recording density sort of factors but also the error free rates. If you try to record on an area that has too thin a coating or a gap in the coating, you won't be able to(or on playback/read the resulting signal will be too weak to be able to) be read properly. These magnetic coating thin spots produce drop out in the tape or disk, areas of loss of signal or information. If the coating thickness varies too much without actually dropping out, that too can be bad for the signal level on playback/read can vary over too great a range, or even with a disk vary cyclically as the disk rotates (with say thicker coating on one half versus the other). The range of signal may be too great for the automatic adjustment circuitry on top of the disk drive unit to compensate for.

The key factor to watch for in diskette specifications is clipping level. A clipping level of 60% or higher is good for that means that the variations in the magnetic coating of the diskette will hold the amplitude variations of the playback/read/load process down as between a minimum of 60% and a maximum of 100% of signal level. The higher the clipping level the better. Of course, not every disk is tested off the assembly line, so that 60% is not a true guarnateed figure when quoted but just has a very high statistical likelihood of being the characteristics of any given diskette from a given sampled batch.

In actual fact, by the writer's experience, cheap diskettes are good enough for most amateurs and do not have an especially high failure rate relative to the more expensive brands. But you still should make lots of back-ups of important work on lots of separate diskettes just to be safe as well as periodic tape backups. Using cassette tapes as archival backup has shown the writer that the longest tape practical is a 90 minute cassette. The 120 minute ones seem too prone to stretching and data corruption due to their thinness.

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*Altho for high speed access it slows recording which factor must be overcome.